In-feed solutions go hand in hand with vaccination efficiency

Vaccination plays a vital role in health management of all poultry species – with growing importance since the ban on the use of antibiotic growth promoters – and is an important tool to reduce the use of therapeutic antibiotics. The primary reason for vaccinating poultry is to minimise the losses due to morbidity and mortality caused by all kind of pathogens.

Treatments	Starter (0-21 days)	Grower (22-42 days)	Vaccination
Negative control	–	–	–
Positive control	–	–	+
Beta-glucan	50g/ton	50g/ton	+

Table. 1. Treatments.

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A breeder is the animal who receives the most vaccination within a short time: up to 28 vaccinations in 18 weeks, quite demanding for the immune system.

A vaccine helps to prevent a disease by boosting the animals' immune system to produce antibodies that in turn fight the invading pathogen, protecting them against disease caused by this specific invader.

As (broiler, layer and turkey) breeders are long living birds, and need to produce offspring, vaccination is important to generate protective immunity against possible diseases for the breeder bird, but also to transfer some protective (maternal) immunity to the offspring.

However, vaccination can never provide 100% protection against infectious diseases. It is only one, but a very important, part of a complex preventive policy, of which biosecurity, hygiene and nutritional programmes are equally essential components. A tool in improving vaccination efficiency, not systematically used yet, is the use of an in-feed supplementation modulating the immune system. Research has shown that response to vaccination can be improved by using immune modulating ingredients administered through the feed, such as beta-glucans.

Vaccination and beta-glucans

Beta-glucans are polysaccharide structures found in bacteria, fungi, algae and plants. Those structures can be recognised by a receptor located on immune cells. After recognition, a further immune modulating effect is induced. Consequently, innate as well as acquired immune responses are fortified.

For vaccination in poultry species, usually a slightly deactivated but live pathogen is orally supplied to the bird. This antigen is recognised by the immune system and as a response, antibodies against that pathogen are produced, protecting the animal against a future threat by this invader. As vaccination relies on a well-functioning immune system, the use of an immune modulating substance, which fortifies innate and acquired immune responses, is beneficial in enhancing vaccination efficiency.

A perfect candidate for such an in-feed supplementation is a beta-(1,3)-glucan derived from a new and unique source; an alga, called Euglena gracilis. Several trials have been performed to gain experience in the effectiveness of this algal derived beta-(1,3)-glucan in enhancing antibody titers and seroconversion in response to vaccination.

Enhancing IBD vaccination efficiency

One of the most common viral infections in chickens is infectious bursal disease (IBD) (or Gumboro disease) and is caused by the IBD virus, which destroys B-lymphocytes in the bursa or Fabricius leading to immuno-suppression, and consequently poor

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Fig. 1. Percentage of seroconverted animals after vaccination.

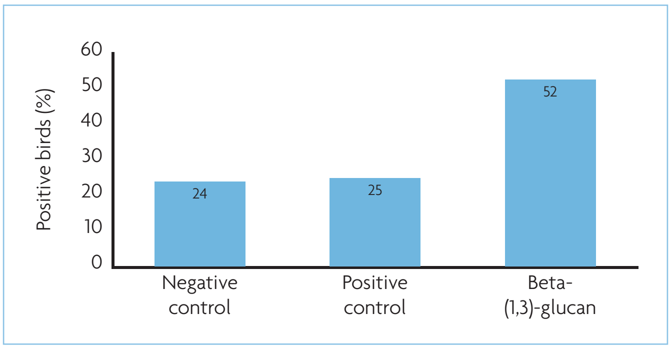
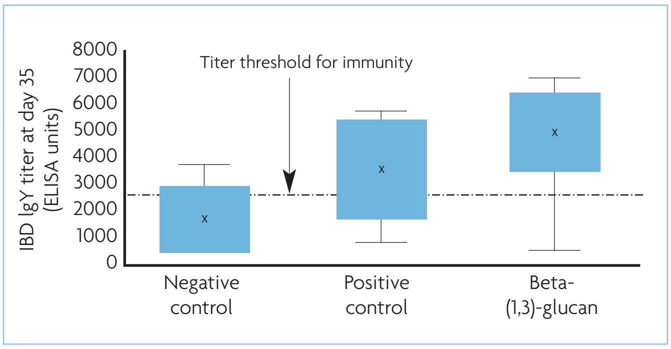


Fig. 2. Average IBD antibody titer (IgY) amongst positive animals (ELISA units).



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performance with significant economic impact.

Vaccination is most important in aiding in IBD prevention and control. Any solution that could enhance the vaccine efficiency is worth trying.

Therefore, a scientific trial was conducted to test the effect of an algal beta-glucan on IBD vaccination. 96 male Ross 308 broilers were divided over three treatments: a negative control group, a positive control group and an algal beta-glucan (Aleta) group. The broilers were orally vaccinated on day 18 with a live freeze-dried IBD vaccine.

To monitor vaccination efficiency, blood samples were taken at day 18 and 35 to measure antibody titers (IgY) against IBD. Measuring antibody titers on day 18 is important to detect if maternal antibodies, which can interfere with the vaccine, are still present, consequently making the bird not susceptible to the vaccination.

During this trial we could observe a 16% higher IBD specific antibody titer (IgY), and 52% more positive (seroconverted) birds, in response to vaccination, in the algal beta-glucan supplemented group compared to the non-supplemented, vaccinated group (positive control).

The negative control group, although not vaccinated, also showed some positive (vaccinated) birds, but with lower average antibody titers, as we could not fully stop the spread of the vaccine virus in the house.

The algal beta-glucan group showed that 52% of all susceptible birds at time of vaccination (without maternal antibodies), seroconverted to the vaccination with an average IgY titer or 4564 ELISA units.

The positive control group consisted of 25% of all susceptible birds at time of vaccination with a positive response to the vaccination with an average IgY titer or 3906 ELISA units.

As the threshold for protective immunity is 2500 ELISA units, more birds showed protective immunity in the beta-glucan supplemented group. Consequently, algal beta-glucan supplementation can enhance seroconversion and serological response to IBD vaccination.

Age	Disease	Vaccine	Administration
Day 1	Marek	HVT and Rispens strain	Intramuscular or subcutaneous injection
Day 1	Gumboro	Live recombinant vaccine	Subcutaneous injection
Day 1	Infectious bronchitis	Live vaccine, Massachusetts strain and/or variant strain	Spray
From day 1	Salmonella enteritidis + S. typhimurium	Live vaccine	Drinking water
10-18 days	Newcastle (ND)	La Sota	Spray or drinking water
When not given at day 1: Day 21 or 28	Gumboro	Live vaccine	Drinking water
3-4 weeks	Infectious bronchitis	Live vaccine, Massachusetts strain and/or variant strain	Spray
6 weeks	ART (TRT)	Live vaccine	Spray
6-8 weeks	Salmonella enteritidis + S. typhimurium	Live or inactivated vaccine	Drinking water or injection
7 weeks	Newcastle	La Sota	Spray or drinking water
7-8 weeks	Infectious bronchitis	Live vaccine, Massachusetts strain and/or variant strain	Spray
9 weeks	ILT	Live vaccine	Eyedrop
	Fowlpox	Live vaccine	Injection
12 weeks	Infectious bronchitis	Live vaccine, Massachusetts strain and/or variant strain	Spray
Before 15 weeks	Avian encephalomyelitis	Live vaccine	Drinking water
End: 3-4 weeks before transfer	Newcastle	Inactivated vaccine	Injection
	Salmonella enteritidis + S. typhimurium	Live or inactivated vaccine	Drinking water or injection
	Infectious bronchitis	Inactivated vaccine	Injection
	ART (TRT)	Inactivated vaccine	Injection

An example of a vaccination schedule for broiler breeder flocks.

Enhancing HEV vaccination efficiency

Another important disease in poultry production is haemorrhagic enteritis (HEV). It is caused by an adenovirus and it targets young turkeys, causing an acute haemorrhagic gastro-enteric disease (clinical), but also suppresses the immune system (subclinical). Disease prevention and control is mainly performed by vaccination.

At a commercial farm, the effect of an algal beta-glucan on HEV vaccination was monitored. The farm contained two houses, one supplied with the algal beta-glucan (100g/ton Aleta), the other not. All animals were orally vaccinated at day 28 with a live attenuated vaccine, and antibody titers in response to the vaccine were monitored at 53 and 100 days. At 25 and 72 days after vaccination the antibody titers (IgY) in response to vaccination were respectively 36% and 32% higher in the algal beta-glucan supplemented group compared to the non-treated group. Due to the improved immune status and disease resistance, mortality was reduced by 32% in the supplemented building compared to the control building. Consequently, this farm is using algal beta-glucan supplementation as a part of their vaccination programme.

An example of a vaccination schedule for a turkey breeder.

Age (week)	Disease	Administration
2-3	Newcastle	Drinking water or spray
4	Haemorrhagic enteritis	Drinking water
6	Fowl cholera	Drinking water or subcutaneous
9-10	Newcastle	Drinking water or spray
12	Fowl cholera	Drinking water or subcutaneous
15	Newcastle	Drinking water or spray
18	Fowl cholera	Drinking water or subcutaneous
21	Newcastle	Drinking water or spray
24	Fowl cholera	Drinking water or subcutaneous
26	Erysipelas, Pox	Drinking water or subcutaneous
28	Newcastle, Fowl cholera, Encephalomyelitis	Subcutaneous, drinking water or subcutaneous, drinking water

Enhancing ND vaccination efficiency

Newcastle disease (ND) is a very contagious viral disease in poultry. Clinical signs depend on the virulence or the strain and the health status or the bird. To prevent outbreaks and

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disease spread, vaccination is obliged in European countries. Turkeys are vaccinated at two or three weeks or age and at eight weeks or age with an inactivated vaccine. Unfortunately, vaccination is not always providing the desired protection level.

Consequently, all tools to support turkeys during those intensive vaccination programmes are explored. ND vaccination efficiency was monitored in two comparable turkey farms, by measuring the specific antibody (IgY) titers in response to vaccination for ND. One farm used algal beta-glucan in the feed during the full production cycle, the other farm did not.

Standard vaccination scheme was performed on both farms. Blood samples were taken at 100 days of age and analysed for Newcastle disease virus (NDV) IgY titer.

Again, the beta-glucan supplied farm showed higher average antibody titers compared to the non-supplemented farm, showing algal beta-glucan could be used as a supportive tool for vaccination programmes in commercial turkey production.

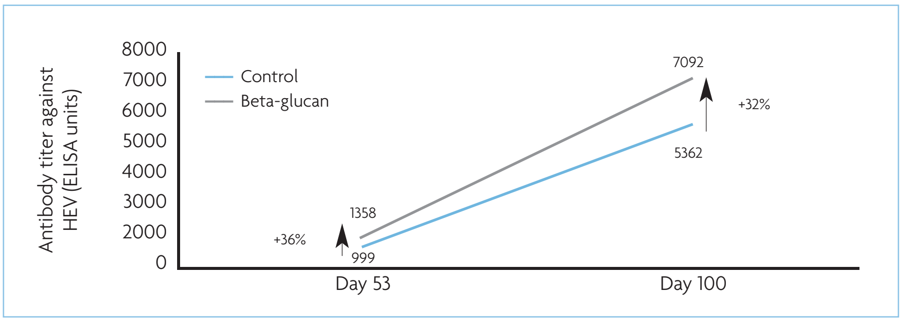

Fig. 3 Average HEV antibody titer (IgY).

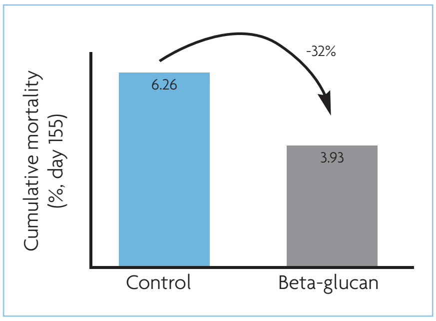

Fig. 4 Cumulative mortality (%) at the end of the fattening period.

Conclusion

Vaccination is gaining more and more interest in disease control and prevention. All tools to improve vaccination efficacy are welcome. A tool not systematically used yet, but which needs to be taken into consideration, is in-feed supplementation of algal derived beta-glucans. They modulate the immune system, preparing it for a response to immunisation, consequently increasing vaccination efficiency. ■

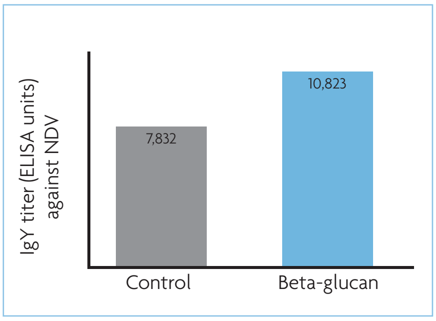

Fig. 5. Average ND antibody titer (IgY).